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**HUNTING MOLLUSCA IN UTAH AND IDAHO.**

BY JUNIUS HENDERSON AND L. E. DANIELS.

The investigations of Hemphill prior to 1890 in Idaho and north-eastern Utah, made that region classic ground in western American conchology. Owing to the existence of many small mountain ranges, in most instances conchologically unexplored, isolated by great expanses of arid territory wholly unfavorable to the larger land snails, in western Utah, Idaho, and Nevada, that area is an attractive field, and some of us have viewed it with longing. It is likely that every range not yet explored will yield one form or more of *Oreohelix* new to science. Indeed, we found a very interesting new form very close to one of Hemphill's localities, and in the same range. Probably Utah is approximately the center of distribution of the genus *Oreohelix*, and a thorough understanding of its forms and their distribution and habits may throw considerable light upon general problems of distribution of plants and animals in the Rocky Mountains and Great Basin, a thing devoutly to be wished. Before beginning serious work upon the unexplored ranges, it seemed to us important to clear up some of the many difficulties arising from a critical study of Hemphill's records and collections, in order to reach a better understanding of his species and varieties. He explored particularly the western edge of the Wasatch mountains and their spurs bordering the Great Salt Lake Basin on the east, thence northward into Idaho and southwestward to the Oquirrh Mountains, which extend southward from the southern end of Salt Lake. His published localities are exceedingly indefinite, as applied to snails of a genus whose colonies are usually of very limited extent and whose varieties are in many instances limited in their known range to the type locality. They were found to be even more indefinite in the field than they looked on paper. In the collections he distributed the labels are still more vague and sometimes misleading. However, we obtained material from somewhere near some of his stations, at least.

Inconsistencies in the descriptions and figures of material collected by Hemphill render the determination of some of the snails of the region difficult. We have been greatly assisted in this work by the loan to the University of Colorado, by Dr. Geo. H. Clapp, of his two

fine series of Hemphill's varieties, which have been critically examined by one of the authors. The other author has some of Hemphill's material in his own collection.

One of Mr. Clapp's collections was formerly owned by Mrs. Geo. Andrews. The shells in this series are mounted on 57 blue cards bearing the printed legend "Genus *Pyramidula*. Group of *Pyramidula alternata*." White printed slips pasted below the specimens use the generic name *Helix* instead of *Pyramidula*, and all of the *Oreohelices* are labelled as varieties of *P. alternata*. All of the printed labels for the Utah material give the localities merely as "near Salt Lake," evidently meaning the lake itself, not the city of that name. Included in that vague locality are shells that undoubtedly came from as widely separated areas as the Oquirrh mountains on the south and Franklin, Idaho, on the north. This collection seems to have been made up during or after 1890, as it includes forms described that year. The other series was purchased by Dr. Clapp directly from Hemphill in 1896, at 25c per lot, 153 trays of two specimens each. The printed labels in this series designate all the *Oreohelices* as varieties of *Helix strigosa*, and the locality stated for all the Utah material is simply "Utah," but in most instances more definite localities, such as "Box Elder Co.," "near Ogden" and "near Salt Lake," have been added with pen and ink.<sup>1</sup>

The soft anatomy of each lot of *Oreohelix* collected alive, with a few exceptions, has been studied by Dr. Pilsbry, whose comments may be found in a separate paper prepared by him. We are also greatly indebted to him for aid in identification of some of our material, and for advice in clearing up difficulties in nomenclature and the literature of the subject.

The authors met, by appointment, at Eureka, Utah, on August 26, 1915, and worked northward into the edge of Idaho, finishing the field work on September 17. Mr. Daniels had visited Stations 1, 1½, 2, 3, 4 and 5 on his way down from Montana to the rendezvous, but we both afterwards visited No. 5, dividing it into three stations, namely 30, 31 and 32, besides visiting others in the same vicinity. The main object of the expedition was to study the *Oreohelices*, and as our time was limited, but little of it was spent in the search for other genera.

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<sup>1</sup> Some of the earlier sets sent out by Hemphill, such as that in the museum of The Academy of Natural Sciences of Philadelphia, have practically the same data on the labels that were given by him in Binney's *Supplement* and *The Nautilus*; most of the labels being printed.

Limestone is common at almost every locality visited, this being a favorable condition for *Oreohelix*. The edges of coarse, angular limestone talus protected from rapid evaporation by overhanging bushes, formed the cover for some of the finest colonies we have seen, the snails occupying crevices among the rocks. At other localities they were abundant under vegetation on limestone slopes totally devoid of talus, and in a few instances they were found in talus where no limestone was observed, though it is almost certain that the soil or rock must have contained a fair percentage of lime in such cases. As some forms were discovered at but one or two stations, we could not determine whether each form chooses definitely a particular kind of cover, but the widely-distributed *depressa* is found indifferently under either rock or vegetative cover. The kind of vegetation did not seem to be important except as affecting its value as a cover to protect the snails from the sun's rays.

In the lots obtained after the first few days of September very few embryos were found. This is unfortunate, as the sculpture and shape of the embryonic whorls are important in classification and they are often much worn in adults. The summer was hot and extremely dry and snails of course were dormant—over ninety days without measurable rain. After the rains commenced on September 2 they became active and filled with water, and large numbers were found in copulation.

A very noticeable feature of the season's catch is the great difference in the color banding of various colonies of what would otherwise be considered the same form. The protean *O. peripherica* (Ancey) is a remarkable example, but scarcely less noteworthy than *O. s. depressa* (Ckll.) and some others. The important fact is that where the banding is weak or wanting on some specimens and strong on others from the same colony, the faintness or absence of bands is most pronounced on the last whorl. This would be interpreted, under the recapitulation theory, to indicate that the color banding is an ancient character of this genus and is in process of disappearing.

The question of recognizing subspecies, varieties and color forms is an ever-recurring one in this genus, many of whose species vary greatly in color, form and sculpture. The practice in American ornithology and mammalogy is to give subspecific rank to geographic races where the great majority of examples in one area differ in the same direction and degree from those of another area. The presence of a smaller number of intergrading forms within the range of either and especially along the common border prohibits specific rank,

the constancy or lack of constancy of characters determining the rank. This method, though requiring a zoological map for the identification of some individuals, seems the most satisfactory way to deal with such cases, where most of the examples from a given area clearly fall into a given subspecies, comparatively few failing to conform; but where mere average characters are used for the separation of such forms, and especially where abnormal specimens are selected and named, it is surely objectionable unless some term is used to indicate a rank lower than subspecies. Professor Cockerell some time ago<sup>2</sup> suggested the use of the term "mutation" to designate sporadic variations from modification of the germ-plasm, "form" for variations resulting from the immediate effect of environment upon the individual, and "variety" for all other variations of lower rank than subspecies. Such use of the terms "mutant" and "form" would imply much greater knowledge of causes of variation than we usually possess. It involves too much guessing as to the cause of a particular variation in a particular case, and in most cases it is impracticable to solve the problem by careful experimentation; indeed, sometimes perhaps impossible. On the other hand, the term "variety" is very confusing because it is so variously used. As is pointed out in the article just referred to, well-known naturalists use it as an exact synonym of "subspecies" and also as a synonym of "form" and "mutant." This was true of Hemphill and Binney, but we should have progressed since their time. Some forms designated varieties by those gentlemen are so distinct that nowadays no naturalist would hesitate to give them full specific rank. On the other hand, however, Hemphill in several cases selected abnormal specimens from a colony and gave them several varietal names, and was not always even consistent in the use of such names in sorting his material for distribution. Had he made it clear in just what instances his varieties were so selected, and in what cases they were really from quite distinct colonies and fairly represented the colonies, it would be easier for us now. If, for example, his *oquirrhensis* and *gabbiana* were from separate colonies as indicated by his notes and partially confirmed by our material, most of the material from one colony conforming to one type and most of it from the other colony conforming to the other type, we should be justified in considering them two subspecies, notwithstanding intergrading examples in either colony. In some cases we can only determine the

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<sup>2</sup> *Nautilus*, XX, 58-60.

question by additional field work, and that is rendered more difficult by the vagueness of his locality data. Sometimes we are aided by a careful reading of all the text of his descriptions. Thus, in reading the descriptions of his *O. subcarinata*, *bicolor* and *lactea*,<sup>3</sup> one without access to his material might well suppose that he was describing really distinct subspecies from separate colonies in the same region, but to his description of *lactea* he added a note to the effect that "the above varieties represent a colony of the largest specimens of the *strigosa* group," etc. From an examination of some of Hemphill's material one of the present authors decided that they were not separable before he noticed that note, and Hemphill was certainly not consistent in sorting these "varieties" for distribution. One might be pardoned, then, for suspecting that his *jugalis* and *intersum*, both from the "banks of the Salmon River," represent a similar instance, but an examination of a small amount of material under those names in Clapp's Hemphill collection indicates that they may be distinct and from different colonies.

In dealing with land snails of the semi-arid region, with their limited locomotive powers and prohibitive environmental barriers between colonies, a colony may be the equivalent of a geographic race or subspecies in other classes of animals. The fact that we do not perceive environmental differences in different colonies which would result in geographic races, may merely represent our ignorance of certain factors or of their importance in snail life. Some perfectly good species and subspecies are known from only one locality. It follows, then, from the foregoing remarks, that if nearly all of the members of a colony or group of colonies vary in the same direction and approximately to the same degree from other colonies occupied by the nearest known relatives, but sporadic individuals of the one are found with the other, then one may perhaps be justified in considering them different subspecies. When not fully satisfied that the difference is of a kind or sufficient in degree to be entitled to specific or subspecific rank, the varietal name may be preceded by the word "form," to distinguish it from a subspecies. There are certain characters which are of doubtful value at all times as subspecific characters, unless accompanied by other differences. Such, for example, is size, which may be greatly influenced in one or more colonies or portions of colonies by exceptionally favorable or unfavorable conditions, as where examples from the midst of a dense thicket

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<sup>3</sup> *Nautilus*, III, 133-134.

are larger than those from the edge of the thicket where cover is poor and periods of activity and growth fewer or shorter. A great many, if not all, mere color variations may fall into the same class, though sometimes color differences may be correlated with other undiscovered differences. As for selecting abnormal specimens which completely grade into the typical form in the same colony and giving to them varietal names, as was done by Hemphill and is now being done by various authors, the value to science of such a practice is doubtful.

Colton,<sup>4</sup> in discussing the genus *Lymnæa*, protests against its generic subdivision, but adds: "Species and minor groups on the other hand cannot be too much subdivided. It is an advance to describe every variation that can be distinguished." Probably no one would object to the describing of all distinguishable variations, but there is room for grave difference of opinion as to the advisability of naming all such variations, which Colton seems to advocate in quoting with apparent approval the following from Bateson: "They will serve science best by giving names freely and by describing everything to which their successors may possibly want to refer and generally by subdividing their material into as many species as they can induce any responsible society or journal to publish." It is quite possible to carry the naming of species and varieties altogether too far, especially in such a genus as *Oreohelix*. One may easily, by taking averages of color, form and size, make a score of colonies of *O. strigosa depressa* into as many distinct varieties, which, when seen in the mass and compared with each other, could be vaguely distinguished, but when compared with all the colonies from which we have collections would be quite indistinguishable, and not at all distinguishable from each other with only a few specimens in hand. Of such is Hemphill's "var. *carnea*."

A nearly complete suite of the material upon which this report is based has been placed in the cabinet of The Academy of Natural Sciences of Philadelphia.

#### THE TINTIC MOUNTAINS.

This is a range of irregular outlines covering considerable territory just west of central Utah. It was hitherto conchologically unexplored, and as we spent but one afternoon collecting here and made but one station, it would doubtless well repay further exploration,

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<sup>4</sup> *Nautilus*, XXVIII, 118.

especially the western spurs, which we did not visit, and which are further from territory thus far explored. Tintic folio, U. S. Geol. Surv., covers the Eureka district.

**Oreohelix cooperi** (W. G. B.)

Sta. 6, on north side of Godiva Mountain, in Eureka, Utah, on a slope of Paleozoic limestone, under shrubs and other vegetation, a few under angular blocks of limestone, no good rock slides exposed. A small form of this species is abundant here. We at first thought it might prove to be new, but it differs from typical *cooperi* of other localities only in its size, and, in average examples, a more nearly pure white ground color. The latter character, however, is quite variable here, but the size is unusually uniform, averaging about 14.5 mm., and varying scarcely a millimeter therefrom, one way or the other.

**Oreohelix hemphilli eurekaensis** new subspecies. Pl. XV, figs. 7, 8.

Shell small, sublenticular; spire slightly elevated; whorls  $4\frac{1}{2}$  to  $4\frac{3}{4}$ , strongly carinated at the periphery, the carina having a tendency to disappear toward the aperture of adults; whorls rounded above, sloping roundly in to the suture so as to form an excavated suture, and on the other hand sloping flatly to the periphery; transverse sculpture well marked, irregular; spiral sculpture consists, in the type, of 6 minute, beaded lines below the periphery, with very indistinct lines in the interspaces and in the edge of the umbilicus; similar sculpture above, but not so well defined nor so plainly of two grades; on the cotypes the lines are not so well defined and not so plainly of two grades below; umbilicus wide, exhibiting all the volutions; apical whorls brown, very dark brown in the type, changing to dirty white on the last whorl; two very obscure dark spiral bands, one above, the other barely below the periphery. Type, in Univ. of Colo. Museum, greater diam. 9.7, lesser 8.8, alt. 5.5. Cotype, in Acad. Nat. Sci. Phila., greater diam. 9.3, lesser 8.5, alt. 6.5.

Type locality, Sta. 6, Eureka, Utah, 7 specimens, all dead shells, associated with *O. cooperi*. The type and cotype are adults, and one specimen in L. E. Daniels' collection probably fully adult but with the peristome partly broken away. These specimens were all submitted to Dr. Pilsbry, who writes as follows: "I at first thought your little species from Eureka was *O. carinifera*, but on further study I am wholly of the opinion that it is a small subspecies of *O. hemphilli*. It differs chiefly by its smaller size and fewer whorls, the sculpture, color and degree of carination being practically identical. *O. hemph-*



*hilli* has the last embryonic whorl a trifle concave near the periphery, where yours is only flattened, but the difference is not great. *O. carinifera* has the embryonic whorls well rounded throughout, above; it is more depressed and the keel is decidedly pinched out on the last whorl. It may turn out to be another subspecies of *hemphilli*, but with present collections I hardly think so. I do not know what form Binney identified as *hemphilli* from Colorado. My comparisons were with the figured type and a young one of the original lot."

#### THE OQUIRRH MOUNTAINS.

This range extends southward from the southern end of Great Salt Lake. Hemphill visited the west side of the range,<sup>5</sup> and reported a very interesting series of finds, with *O. utahensis* at the foot of the mountains, *O. oquirrhensis* a short distance up the mountain side, then along the mountain side across a ravine the typical *haydeni* and *gabbiana*, and near the summit a few *haydeni* and two *cooperi*. We searched the canyons around Tooele without finding any of these forms. Then we proceeded to Garfield and worked southward along the west side of the range for many miles and only found one species, at stations 14 and 15. Material labelled *haydeni* in Clapp's Hemphill collection does not appear to belong to that species.

Station 11, cottonwood grove at picnic grounds just within mouth of gulch southeast of Tooele from which gulch the town obtains its water supply.

*Paludestrina longinqua* (Gould), abundant in water-cress.

*Pyramidula cronkhitei anthonyi* Pils., 14 specimens.

*Euconulus* sp., 1 juvenile.

*Vitrina alaskana* Dall, 2 dead shells.

*Zonitoides arborea* Say, 3 specimens.

*Pupilla blandi* Morse, 1 specimen.

Station 12, up the canyon a short distance above Station 11, in rock slide, mostly quartzitic sandstone.

*Vitrina alaskana* Dall, 3 specimens.

*Pyramidula cronkhitei anthonyi* Pils., 3 specimens.

*Vitrea indentata umbilicata* (Ckll.), 12 specimens.

*Oreohelix strigosa depressa* (Ckll.) common.

***Oreohelix strigosa depressa* (Ckll.).**

Sta. 12 (see above); Sta. 13, about a mile above Sta. 12, on south side, under mountain maple leaves. These two lots are typical in

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<sup>5</sup> Binney's 2nd Suppl. to 5th Vol. Terr. Moll. U. S., pp. 29-34.

form, sculpture, color and size, as compared with average examples from Colorado, with two strong color bands, one barely below the periphery, the other well above. Probably all or nearly all of Hemphill's Utah records of *O. strigosa* (Gould) should be referred to this subspecies. This is true of the material labelled *strigosa* in Clapp's Hemphill collection.

***Oreohelix strigosa depressa*, form *tooeleensis* new form.**

This form differs from *depressa* chiefly in the color, which is almost invariably a dead, chalky white, in all the material from three colonies northeast of Tooele, Utah, giving the specimens the appearance of dead, weathered shells, in this respect quite unlike the colonies of *depressa* from southeast of Tooele and elsewhere. Shell depressed (in a few examples quite elevated); whorls 5 to  $5\frac{1}{2}$ , convex; suture well impressed; spiral striæ minute; transverse sculpture slightly less pronounced than in typical *depressa*, especially below; color bands narrow, sometimes strongly marked, but usually rather faint or wanting, one barely below and the other well above the periphery, strong on immature examples; first embryonic whorl smooth, second and third minutely transversely striate, with numerous spiral striæ rippling the transverse sculpture above and below and increasing in strength with the growth of the whorls. Type, in the University of Colorado Museum, greater diam. 19 mm., lesser 16.5 mm., alt. 11.5 mm. Co-type, in Academy of Natural Sciences of Philadelphia, greater diam. 19.6 mm., lesser 17.2 mm., alt. 11.4 mm. Co-type, in L. E. Daniels' collection, greater diam. 23 mm., lesser 20 mm., alt. 13.5 mm. This form also slightly differs from typical *depressa* in anatomy, according to Dr. Pilsbry, but this is a variable feature. The presence sporadically of white examples in *depressa* and other colonies of *Oreohelix* belonging to the *strigosa* group, even though not the dead white which characterizes this form, makes it inadvisable to give this subspecific rank, notwithstanding the fact that the color in these colonies is constant, unless other differences are found which are also constant. Abundant at stations 7, 8, 9 and 10, in the small gulches about six miles northeast of Tooele, north of the smelter, under grass and other vegetation about limestone ledges. Four sinistral specimens were found.

***Oreohelix haydeni gabbiana* (Hemphill). Pl. XVI, fig. 3.**

*Patula strigosa* var. *gabbiana* Hemphill, per Binney, 2nd Suppl. to 5th Vol. Terr. Moll. U. S., pp. 30, 34, Pl. II, fig. 9, 1886.

Sta. 14, mountain side southwest of Garfield (southeast of Black Rock) west side of Oquirrh Mts., under bushes, on limestone. The

locality had been burned over some years ago, and though the shrubbery had re-established itself, we found no live snails. The "bones" had been long dead. A more thorough search would likely disclose live ones in the neighborhood, as fires usually leave "islands" where such species may be preserved alive. Dead shells were fairly plentiful. A careful conchological survey of this whole range would probably prove profitable. Especially should Hemphill's "*haydeni*," *oquirrhensis* and *utahensis* from this vicinity be investigated.

Sta. 15, south side of a gulch south of Sta. 14, nearly east of Morris, under shrubbery and other vegetation about limestone ledges, not under rocks. This locality had been very recently burned over and the fire was still raging to the southward. We found numerous examples of this species on the burned ground, in a crumbly condition owing to the heat, but in a few small patches of brush untouched by the fire we found about thirty live ones. It is not improbable that the gulch where the fire was burning is the Hemphill locality.

The examples from Sta. 14 are old and much weathered, so that the sculpture is obscure on most of them, but where preserved it is the same as in those from Sta. 15, though the carina is not so pronounced on the average, and they vary more in size and altitude. This is a strongly carinated form, otherwise resembling Hemphill's variety *hydrida*, from Logan. In the best specimens the revolving riblets may be seen with the naked eye, with revolving threads in the interspaces visible under a lens, the intersections of these riblets and threads with the irregular transverse riblets, give to it a knobbed appearance as seen under a lens. This sculpture is characteristic of the *haydeni* group. The primary revolving riblets, six or eight in number, are rather regularly spaced, especially below. Most of our specimens are under 16 mm. in diameter, but the largest one measured is 22 mm., and has two rather strong color bands, one barely below and the other well above the periphery.

#### THE PROVO DISTRICT.

Provo is south of Salt Lake City and at the base of the same range of mountains, hence it is not surprising to find the same species common here. Hemphill reported "typical *strigosa* and *cooperi*, large and small," from this locality. Doubtless his *strigosa* was *depressa*.

***Oreohelix strigosa depressa* (Ckll.).**

Sta. 44, visited by Daniels only, Rock Canyon, due east of Provo, in limestone slides bordered by oak brush. Many examples with the color bands faint or wanting, a few strongly banded. Two sinistral shells were found. Shows same anatomical peculiarity as at Tooele, Sta. 7.

Sta. 45, visited by Daniels only, Slate Canyon, first one south of Sta. 44, limestone slides bordered by scrub oak brush. Banding even less prominent than at Sta. 44.

## THE SALT LAKE CITY DISTRICT.

***Oreohelix strigosa depressa* (Ckll.).**

Sta. 46, about a mile up Emigration Canyon, southeast of Salt Lake City, south side of canyon, under mountain maples and other vegetation in fine limestone slide rock. This is a strongly banded form whose anatomy, according to Dr. Pilsbry, agrees with that of *depressa* from Colorado Springs and other localities, as well as from our stations 2 (near McCammon, Idaho) and 28 (near Brigham, Utah). The shells, however, of this lot and those from Sta. 2 differ markedly from those of typical *depressa* from Durango, Morrison, Steamboat Springs and other Colorado localities. Their relative altitude and the altitude of their whorls in proportion to the transverse diameter are much greater, and they scarcely show any of the peripheral subcarination in front of the aperture so common, indeed almost universal, in Colorado shells of this subspecies. On the other hand, however, other lots from elsewhere in Utah, notably near Ogden, appear to grade this lot quite well into typical *depressa*, so that, from any information we now have, we do not dare to make any separation. *Oreohelices* usually differ in relative altitude within any given species or subspecies, and only the uniformity of the increased altitude in this colony makes us hesitate.

***Oreohelix strigosa depressa* (Ckll.). "var. *carnea*" (Hemph.).**

*Patula, strigosa* var. *carnea* Hemphill, *Nautilus*, IV, 15, 1890. Binney, 4th Suppl. to 5th Vol. Terr. Moll. U. S., p. 174, 1892.

Sta. 43, Dry Canyon, about a mile from the University of Utah, near Salt Lake City, in scrub oak and mountain maple thickets on limestone, visited by Henderson in company with William McArthur. This form was found abundantly here, the color bands faint or wanting on most examples, but quite strong on a few. On an average the specimens have a higher spire than typical *depressa*, but many of them are well depressed. The description of *depressa* appeared

in the same magazine in January, 1890, the reference to Binney's figure seeming to make it a good description, thus antedating *carnea* by five months. *O. var. carnea* is not a well-marked variety, and the question of making it a subspecies, or a mere color variety, or rejecting the name altogether, may be purely a matter of opinion, but it is not quite typical *depressa*.

Hemphill records "typical *strigosa* and *cooperi*, both large and small," from near Salt Lake City.

#### THE OGDEN DISTRICT.

##### *Oreohelix strigosa depressa* (Ckll.).

Sta. 20, about eight miles up Ogden Canyon, east of Ogden, in rock slide below a limestone ledge at southwest end of a railroad bridge, south side of creek. Large, fine specimens, abundant, strongly banded, some measuring over 26 mm., a few very dark-colored. Professor Cockerell says this is the sort of snail he called "form *major*."<sup>6</sup>

Sta. 21, north side of creek,  $\frac{1}{4}$  to  $\frac{1}{2}$  mile below Sta. 20, under mountain maples, a few large specimens, up to 26 mm., and up slope in rock slide, the same form abundant, but averaging smaller, about 21 mm.

Sta. 22, south side of creek, half a mile further down, in slide of limestone and a micaceous rock, same subspecies, large, exceedingly abundant. Also half a mile further down under similar conditions. Dr. Pilsbry says of the *Oreohelix* from this station. "This lot is representative of a race of *strigosa* slightly differing from *depressa* in anatomy. The shells seem to me to differ by being less sharply striate, but were it not for the genital difference I would probably not have noticed this." A later letter, however, says that two lots afterwards examined seem intermediate, so that the argument from the anatomy is weakened, and there is no appreciable difference in the shell characters. The same anatomical differences he noted for stations 7, 10 and 13, near Tooele.

Sta. 23, further down creek on south side, opposite thick deposit of consolidated Quaternary gravel, in gneissic slide rock and adjacent bushes, with limestone showing far up slope at top of canyon wall, from which the wash is down over the slide. The same subspecies of *Oreohelix*, abundant, mostly rather high-spined.

At Sta. 22 we found also one of each of the following species:

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<sup>6</sup> See *Nautilus*, III, 102.

*Succinea avara* Say.

*Thysanophora ingersolli* (Bland).

*Agriolimax campestris* (Binney).

It may be well to add that this canyon is the type locality of *Vertigo corpulenta parietalis* (Ancey), and that Hemphill's *Patula striatella* from here is probably *Pyramidula cronkhitei anthonyi* Pils.

***Oreohelix strigosa buttoni*** (Hemph.). ?. Pl. XVI, fig. 2.

*Patula strigosa* var. *buttoni* Hemphill, in Binney's 3rd Suppl. to 5th Vol. Terr. Moll. U. S., p. 220, 1890, Box Elder Co., Utah. Binney, 4th Suppl. 5th Vol. Terr. Moll. U. S., p. 171, Pl. I, figs. 2 and 10, 1892.

Stations 16, 17, 18 and 19, Taylor Canyon, near Ogden, south of Ogden Canyon, under poison ivy, elderberry, mountain maple and other shrubbery about limestone ledges, the farthest station being about half a mile up the canyon, and 19 being just outside the canyon and to the south, at an old lime kiln. Color light brown to nearly white, color bands from very faint to strong, varying somewhat in width.

Sta. 24, half hour's walk below Gateway, in Weber Canyon, southeast of Ogden, Utah, on south side of canyon in gneiss slide rock, no limestone seen, and another similar slide half a mile farther down.

Sta. 25, about half mile above mouth of Weber Canyon, south side, south of canal, 400 to 500 yards below Utah Light and Railway Co.'s power plant, in a similar slide.

Dr. Pilsbry has examined material from all these stations except 19, and identified it as above. Many examples have strong spiral color bands, and nearly all from 17 have. Otherwise they agree well with those under this name in Clapp's Hemphill collection. The tooth on the columellar margin is very often absent.

At Sta. 17 we also found *Vitrina alaskana* Dall.

***Oreohelix peripherica*** (Ancey). Pl. XV, fig. 1.

Sta. 26, west side of gulch which comes into North Ogden Canyon half a mile or so above its mouth, abundant in scrub oak and other brush on hard sandstone and conglomerate overlaid by limestone, but not found in rock slide. This species and its varieties are more fully discussed under the Cache Junction District. At Sta. 26 the specimens collected average larger and smoother, but present the usual variation in size, as well as in the coarseness of sculpture and elevation of the spire. Many are plain, others with two narrow bands, either faint (especially on the last whorl) or well-marked, but none here with the broad, nearly black bands and white periphery of the *albofasciata* type, though some show a very slight tendency in

that direction, while a few have a faint chestnut tinge suffusing the whole shell, suggesting a tendency to approach the form *castaneus*. Two reversed examples were found.

#### THE BRIGHAM DISTRICT.

At Sta. 27, at a spring beside a poplar grove just outside the mouth of the first canyon north of Brigham, Utah, in a thin film of water flowing over small rocks, we found a small form of *Physa*, which is tentatively identified as *P. cooperi* Tryon (?) by Mr. Bryant Walker, who adds: "Though slightly larger, these agree very well with some from California named by Hannibal."

#### *Oreohelix strigosa depressa* (Ckll.).

Sta. 28, up the steep canyon east of Sta. 27, in sandstone and limestone slides at edge of small mountain maple and oak thickets and other shrubbery. Conditions were not very favorable and specimens were rather scarce and small, not running above 19 mm. in diameter.

#### THE CACHE JUNCTION DISTRICT.

We include in this district the Wheelon, Clarkston and Newton stations, as they are all within a few miles of Cache Junction, Utah, and most of them produced some form of *Oreohelix peripherica* (Ancey), which we wish to discuss somewhat fully. At the stations south and west of the Junction we found the most interesting colonies of *Oreohelix* we have ever visited. Hemphill collected the same forms not very far from our stations, and recorded and distributed them variously as from the "banks of Bear river, North of Brigham," or simply "Box Elder County, Utah." Our stations 29, 30, 31 and 32 are close to the Bear River, in Cache County, just east of the Box Elder County line. Indeed, 29 may be really within Box Elder County. Stations 33 and 34 are just west of the line in Box Elder County, and likewise close to the river.

Hemphill camped on the "banks of the Bear River," north of Brigham, where the valley "was considerably broken by mountain spurs, through one of which the river had cut its way, leaving high, rocky cliffs on either side, with scattered clumps of bushes along the river and on the edges of the bluffs." Wheelon is located just where the river leaves the gorge, our Sta. 33 is not far below Wheelon, 34 within the gorge above Wheelon, 30, 31 and 32 just within the upper part of the gorge, 29 on the bank of the river just above the entrance to the gorge, while Cache Junction itself is in the valley

perhaps a couple of miles up the river from the gorge. A careful consideration of the topography and biological conditions, in connection with Hemphill's notes, convinced us that his camp was just below Wheelon, for in his search for *Oreohelix* he would surely have camped close to the mountains, the valley here being quite unfavorable to land snails. His first find was "on the brow of the bluff and the slope towards the river," evidently near his camp and surely not far from our Sta. 33. There he found his *O. binneyi*, "all plain white." Binney adds, "no revolving bands of color," but his figure seems to indicate one faint, narrow peripheral band. Next he found, apparently near by, "in a clump of bushes among leaves and brush," his variety *albofasciata*, shell "clouded, with the broad, revolving white band at the periphery. None in the bushes were white." (Later, he modified and extended the description, with an added figure.) At the various stations where we found typical *albofasciata* our experience was quite the reverse. We found at some stations the unbanded and narrowly-banded forms without *albofasciata*, but nowhere did we find *albofasciata* without a large proportion of the unbanded and narrowly-banded forms, a peculiarity of distribution reminding one of such instances as the sinistral forms of *Pupilla hebes* and *syngenes*, and the *bigranata* form of *P. muscorum*, which may be found in either pure or mixed colonies. There are reasons for surmising that Hemphill sorted his material in the field and wrote his published notes long afterward from memory; which, if it be the case, may account for the discrepancy in our finds. Then at the rocky cliffs three miles from camp, presumably somewhere near our stations 30, 31, 32 and 34, he found *binneyi* among the bushes, and "the ribbed variety *castaneus*" (Binney's figs. 11 and 14), "on a mossy, grassy slope directly at the foot of a high cliff," a spot which he says was continually shaded from the sun throughout the day. Across a ravine at the foot of another cliff, in wild rye, he found *gouldi* (Binney's figs. 5 and 16), all small, this form having two narrow dark bands, according to the figures. All these forms are transversely ribbed. At every station we found them intermingled, enormously variable in size, shape, color and sculpture, so completely grading together that we were compelled to believe them to belong to one protean species, and the same as Ancy's previously described *peripherica*, a conclusion reached also by Dr. Pilsbry some time ago.<sup>7</sup>

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<sup>7</sup> *Nautilus*, XXVII, 153.



[*Patula strigosa*] var. *newcombi* was named without description by Binney in 1885 (Man. Amer. L. Shells, p. 481), designating U. S. Natl. Mus. Nos. 39,023 and 39,025 to 39,038, from "near Ogden," "Wasatch Mountains" and "Box Elder Canyon." In his Second Suppl. Terr. Moll., 1886, he figured and briefly described it, hence the name is valid only from that date. The description and figures indicate much fewer and more widely spaced ribs than any of our material from that region. *O. wasatchensis* (Hemph.) may connect up with *peripherica* as a subspecies, through *newcombi*, but it is doubtful, and until that problem can be investigated it seems better to consider it a full species.

**Oreohelix peripherica** (Ancey). Pl. XV, figs. 1, 2, 3, 4

*Helix idahoensis* Newcomb, var. *peripherica* Ancey, *Le Naturaliste*, IV, 403, 1881.

*Patula strigosa*, vars. *binneyi*, *multicostata*, *gouldi*, *albofasciata* and *castaneus* Hemphill, in Binney's 2nd Suppl. to 5th Vol. Terr. Moll. U. S., pp. 29-32, Pl. II, figs. 3-6, 8, 11, 13, 14, 16, 1886; 4th Suppl., p. 171, Pl. 4, fig. 9, 1892.

*Patula peripherica* (1882, *multicostata* 1886) and *castaneus*. Ancey, *The Conchologists' Exchange*, II, 64, 1887.

*Pyramidula strigosa binneyi* and forms *multicostata*, *castanea* and *albofasciata* Pilsbry, *Naut.*, XI, 141, 1898; *Cat. Amer. Land Shells*, p. 32, 1898.

*Oreohelix peripherica* and local races *binneyi*, *newcombi*, *multicostata*, *gouldi*, *albofasciata* and *castaneus* Pilsbry, *Naut.*, XXVII, 53-54, 1913.

The following is a free translation from the French of Ancey's original description:

"I owe to the kindness of Dr. Newcomb a second variety of this species, with the same shape as the first one, but with a more open umbilicus, ornamented on the periphery with two narrow brown lines, the lower one being more decidedly marked, and provided with ribs, close, irregular and little in relief. It so closely resembles the shape of *Helix (Anguispira) cooperi* W. G. Binn., that I think it might well be an hybrid displaying the characteristics of the *Helix idahoensis* and *cooperi*. It measures 9 mm. in height and 14 mm. in diameter, and comes from Utah. As to form and color it looks much like the *Helix cooperi* (No. 136) of Binney and Bland's Land and Fresh-water Shells of North America, but it has ribs, while the latter has none. I propose to name this interesting variety *Helix idahoensis* Newcomb var. *peripherica*."

The "first one" referred to above is *O. idahoensis*. We see no reason for making this a subspecies or variety of either *idahoensis*, *strigosa* or *cooperi*. It is interesting to note that Ancey himself pointed out its identity with *multicostata* and the priority of his name, in his paper above cited from *The Conchologists' Exchange*. A careful study of Hemphill's material in the Clapp collection, taken in

connection with a study of our own material, both in the field and in the laboratory, convinces us that the forms mentioned in the foregoing synonymy should not be separated as subspecies. Some of the names may be useful as descriptive terms, provided they are used in such a way as to indicate their rank. The form *albofasciata*, especially, is a good color form, but the same variation is seen in various colonies of *depressa* and *cooperi*, though seldom or never quite so strikingly developed.

Hemphill says of *castaneus* that most of them are "faintly marked with the broad white band of *albofasciata*, but a few are plain chestnut colored." This is exactly the variation that occurs sporadically in many colonies of *depressa* and *cooperi*, and did not warrant the sending out of material from that colony under a distinct name, though it may have been appropriate to have selected the plain chestnut-colored examples and sent them out as mere color forms. Four specimens in Clapp's Hemphill collection are labelled *castaneus*. Two of them, from Box Elder County, Utah, are almost typical *albofasciata*. The other two, from Eastern Oregon, are not at all closely related to the others, and appear to be simply dark, unbanded examples of some undetermined species such as so frequently occur sporadically. The separation of the forms *multicostata* and *gouldi* was based chiefly upon a slight difference in the number and prominence of the ribs. As the ribs are extremely variable at all the stations of the species, and the material separated and labelled by Hemphill shows minute gradation in this respect, as well as in color and form, throughout his whole group of "varieties" from this district, probably no good purpose is served by retaining both of the names, though the average of the ribbing is so much more pronounced at some localities that it may be convenient to retain one of the names without giving it subspecific rank, in which case *multicostata* should be selected.

Sta. 29, steep east bank of Bear River below Cache Junction, just above the entrance to the gorge by which the river breaks through the mountain range to Wheelon, under shrubbery on whitish limestone. *Oreohelix*, connecting the unbanded forms of *peripherica* with the strongly banded *albofasciata* form. In examining 69 live specimens from a space about two rods wide and several rods long, 30 (form *binneyi*) are found to have scarcely a suggestion of color bands; 26 (form *albofasciata*) have a dark band 3 to 4 mm. wide just below the suture, then a white peripheral band of about the same width, a dark band below the periphery varying from 1 to

4 mm., the lower margin of this band irregular, often producing a "clouded" effect, and a broad white band around the umbilicus, such as sometimes occurs around the umbilicus of strongly albofasciated types of *cooperi* and *depressa*; 13 grade almost insensibly from the *albofasciata* form to the *binneyi* form. Frequently a narrow white band occurs just below the suture, and the upper edge of the white peripheral band is exposed well up the spire, of the higher-spired *albofasciata* specimens. Transverse ribs average about two to the millimeter, rather irregular, growth lines showing in the interspaces and microscopic spiral striæ on the ribs and in the interspaces. The color bands are very dark, often forming a striking contrast with the white peripheral and umbilical bands. Diameter 15 to 19 mm. (Pl. XVII, fig. 2.)

Sta. 30, southeast of Sta. 29, directly opposite the power plant dam at the entrance to the gorge, at base of Paleozoic limestone rocks on the lower slope of the mountain, where the vegetative cover is poor and rock slide absent or unexposed. Form *multicostata*, banding weak or absent, ribbing pronounced, diameter 12 to 16 mm., mostly dead specimens, the slope having been very recently burned over. (Pl. XV, fig. 2.)

Sta. 31, farther up the slope, at a heavy, steep limestone ledge, beneath a decumbent species of polygonaceous plant which clings closely to the rock. Form *multicostata*, abundant, much smaller than at Sta. 30, most examples with a narrow and often faint subperipheral color band, and some with a similar band just above the periphery; diameter of adults from 8 to 12 mm., altitude extremely variable (Pl. XV, fig. 3). The snails increase in size again a hundred feet farther up the slope. Stations 30, 31 and 32 form practically a continuous colony, which we separated into stations merely because of the astonishing difference in size within a short distance. Our observations upon this genus lead us to observe that any given species is likely to vary greatly in size with variation in cover. We also found here 97 *Pupilla blandi* (Morse) and 5 *Vallonia cyclophorella* Ancey and *V. sonorana* Pils.

Sta. 32, at the base of a limestone cliff above Sta. 31, where the vegetative cover is better and the cliff affords considerable shade. Forms *albofasciata* and *binneyi*, intergrading as at Sta. 29, except that few are so pronouncedly of the *albofasciata* type as at 29. Diameter from 9 to 16 mm.

Sta. 33, ravine that cuts back into the east bluff of Bear River valley, just below Wheelon, Box Elder County, probably not a great

distance from Hemphill's camp, above irrigation canal, in a dense thicket of birches and mountain maples. Forms *albofasciata* and *binneyi*, showing the same intergradation as at Sta. 29, but a smaller proportion strongly banded. Of 324 live ones examined, only 39 showed very marked bands, most of which were as heavily banded as at 29. Diameter 16 to 18 mm. In the dried-up backwater from the canal at this point we found 80 *Lymnaea parva* Lea (identified by Walker), 1 *Planorbis parvus* Say, 7 *Physa gyrina* Say (?), 2 *Zonitoides arborea* Say and 1 *Vitrina alaskana* Dall.

Sta. 34, above Wheelon, in a ravine on the east side of the gorge, at the south end of the railroad bridge southwest of the tunnel, only a few rods within the eastern border of Box Elder County, under mountain maple, scrub oak and other brush. The same forms of *Oreohelix* as at stations 29 and 33, but the *albofasciata* form proportionately more numerous than at Sta. 33, the banding varying greatly in degree as elsewhere.

It will be noted that wherever the form *albofasciata* was found, it was associated with the *binneyi* form, and that at none of the *albofasciata* stations was the ribbing as pronounced as at stations 30 and 31, at which none of the typical *albofasciata* were found. This suggests that notwithstanding the complete intergradation in all the observed characters of these snails at stations 29 to 34, it may become necessary to recognize two distinct subspecies. In that event the name *peripherica* should be adopted for the *multicostata* form, because it better conforms to Ancey's description and Ancey himself recognized the identity of these two, and did not recognize their identity with any of the other named forms. Then the forms from stations 29, 33, 34 and 37 may be called *O. peripherica binneyi* (Hemph.), with *albofasciata* as a color form. Living specimens from these stations have been retained for breeding experiments.

Sta. 37, about five miles across the valley due west of Sta. 36, a mile or so southwest of Clarkston, in a ravine in the east slope of the same narrow mountain range that the river cuts through at stations 29 to 34, and probably not more than three miles northwest of 29, under low bushes. The *binneyi* and *albofasciata* forms, showing the usual intergradations. From the topographic and biologic conditions observed at a distance, it is not unlikely that this colony extends with a few narrow interruptions, to a point on the river bank just opposite Sta. 29.

Sta. 36, west slope of a small, rounded, barren-looking, isolated,

calcareous mountain northeast of Newton, due east of Sta. 37, under the shrub *Kunzia tridentata* and weeds. We found here, on a very unpromising slope, in considerable abundance, an *Oreohelix* which appears to be identical with the smooth form of *peripherica* from Sta. 26, in North Ogden Canyon, but the specimens average somewhat smaller at Sta. 36 and more in keeping in this respect with the other *peripherica* stations.

***Oreohelix rugosa*** (Hemph.).

*Patula strigosa* var. *rugosa* Hemphill, Naut., IV, 16-17, 1890. Binney's 4th Suppl. to 5th Vol. Terr. Moll. U. S., p. 174, 1892.

Sta. 3, a little north of west from Clarkston, on the east slope of the same mountain range as Sta. 37 and not more than two or three miles distant, probably about one-third of the way up the mountain, under scrub oak and sage brush. A comparison of this material with *O. rugosa* in Clapp's Hemphill collection shows them to be identical. The shells remind one of *O. hendersoni* Pilsbry, or rather of the subspecies *dakani* Henderson, but Dr. Pilsbry's anatomical examination disproves its relationship to *hendersoni*. It must be remembered, however, that the connection between *hendersoni* and *dakani* is hypothetical, and *rugosa* may prove to be a prior name for the latter. The anatomy indicates a closer relationship to *cooperi* than to *strigosa* or *depressa*, but the shell characters do not appear to grade it into any of those forms, so it is for the present assigned to specific rank. The specimens vary greatly in altitude, as is so frequently the case in this genus.

***Pisidium huachuacanum*** Pils. and Ferr.

Found in a spring at Clarkston, Utah, associated with the next species. Both identified by Dr. Sterki.

***Paludestrina longinqua*** (Gould).

In a spring at Clarkston, Utah.

On the bank of Bear River, due west of Cache Junction, we found a single dead shell of *Planorbis trivolvis*. At Sta. 35, a brook northeast of Newton, we found a *Physa* rather plentiful, which was tentatively identified by Mr. Bryant Walker as *P. distinguenda* Tryon (?), but Dr. Pilsbry says it "agrees very exactly with the type of *Physa cooperi*."

THE TRENTON DISTRICT.

Trenton, Utah, lies a few miles to the north of Newton and Cache Junction.

**Oreohelix peripherica** (Ancey).

Sta. 4, "The Cliffs," one mile south of Trenton, on a small, isolated mountain similar to Sta. 36. The smooth form of this species, like that found at stations 26 (North Ogden) and 36 (Newton), was found here. A few show the strong ribbing of the form *binneyi*, but the ribs are not so prominent as in the form *multicostata*. A fire had recently destroyed the brush and leaves, so live specimens were scarce, but dead shells were abundant. Two abnormal specimens are represented on Pl. XV, fig. 4.

**Sphaerium pilsbryanum** Sterki.

A few dead shells found in an irrigating ditch near Trenton, from which the water had been withdrawn for some time. The species was described from Bear Lake as a fossil or subfossil. Dr. Sterki writes that he has one fresh specimen from Utah Lake.

## THE LOGAN DISTRICT.

Binney recorded *Thysanophora ingersolli* (Bland) under the generic name *Microphysa*, from Logan Canyon, collected by Hemphill (2nd Suppl. Terr. Moll., p. 35). It is probably the same form that Ancey, 1887, described from the same canyon as *M. ingersolli convexior* (Conch. Exch., II, 64). We did not visit this canyon.

**Oreohelix strigosa depressa** (Ckll.).

Sta. 41, first gulch south of Logan Canyon, east of Logan, Utah, in the edges of Paleozoic limestone talus. A small form of this subspecies, running about 18.5 mm. in diameter, mostly strongly banded, a few plain, not abundant, conditions evidently rather unfavorable. A few examples strongly resemble *O. "var. albida"* (Hemph.), the type locality of which is "near Logan."

**Oreohelix haydeni hybrida** (Hemph.). Pl. XV, fig. 4.

*Patula strigosa* var. *hybrida* Hemphill, Naut., IV, 17, 1890.

Sta. 42, not far within the mouth of the next gulch south of Sta. 41, under mountain maple and other shrubbery, herbs and rocks. The snails were found in fair abundance, a few with color bands, sculpture almost exactly like that of *O. h. gabbiana* from stations 14 and 15, but the keel is much less pronounced and often almost wanting on the last whorl. This is doubtless the form that Hemphill first recorded as "the variety with microscopic ribs, beginning of *haydeni*, among stones at the head of a gulch high on the mountains" (Binney's 2nd Suppl. Terr. Moll., p. 31), possibly the same gulch from which we collected it. Later, in describing and naming the subspecies, he explained that it "is the beginning of the forms of *strigosa* that

finally develop the revolving lines into prominent ribs as seen on the surface of var. *haydeni* Gabb."

#### THE FRANKLIN DISTRICT.

Franklin is situated in Idaho, a mile or two north of the northern line of Utah, and Sta. 38 is in Idaho, but stations 39 and 40 are a mile and a half or two miles south of the line, in Utah.

*Oreohelix strigosa fragilis* (Hemphill). Pl. XVI, fig. 1.

*Patula strigosa* var. *fragilis* Hemphill, Naut., IV, 17-18, 1890. Binney's 4th Suppl. Terr. Moll., pp. 174-175, 1892.

Sta. 38, a small, isolated, barren-looking mountain about a mile west of Franklin, Idaho, in the edges of Paleozoic limestone slides surrounded by sage brush. The specimens from this station are small (few exceeding 17 mm. in diameter), much depressed, not quite so fragile as from the next station, and with a wider umbilicus, as would be expected from the depressed form. The noticeably translucent shell and general appearance, however, connects them with this subspecies, rather than with typical *depressa*. From this station we have also 1 *Vallonia cyclophorella* Ancey, 1 *Pupilla blandi* (Morse) and 2 *Succinea avara* Say.

Sta. 39, Prater Gulch, south of High Creek Canyon, Utah, about six miles southeast of Franklin, Idaho, nearly east of the railroad station of Webster, Utah, in quartzite talus. Rare in several slides visited, very abundant in one. The specimens are typical, but rather larger than most of those in Clapp's Hemphill collection, averaging about 20 mm. in diameter, altitude variable in its proportion to transverse diameter, but nearly all higher than the average from Sta. 38. This subspecies is closely allied to *depressa*, but differs slightly in anatomy, in the translucency and fragility of the shell, and in the narrowing of the umbilicus by the reflected base of the columella. Near Franklin, on red sandstone, is given as the type locality. One might be led to suspect that the fragility of shell is due to lack of lime, from the fact that Hemphill's material came from sandstone and our No. 39 from quartzite, but the snails from Sta. 38, in a limestone habitat, are also fragile, though to a less degree, while *depressa* from quartzite slides are not fragile. The Sta. 39 shells are so fragile that many of them were broken in carrying them in the bags until we found time to clean them, a thing which did not happen with any other *Oreohelices* we collected, and they were not subjected to as hard usage as some. Indeed, it was the fact that they broke so easily that attracted our attention in the

field to the probability that we had Hemphill's *fragilis*, which neither of us had seen before.

At this station *Vitrina alaskana* Dall was noted, but not taken.

**Oreohelix haydeni corrugata** new subspecies. Pl. XVII, fig. 1.

Shell rather globose; spire elevated, one or two examples tabulate; whorls 5 to  $5\frac{1}{2}$ , ample, convex, last one scarcely carinated at the periphery on elevated specimens; spiral sculpture strong, closely resembling that of typical *haydeni* and the subspecies *betheli*, consisting of an average of about 13 strong, sharp ridges (in a few examples scarcely stronger than the riblets), the interspaces much broader and occupied by from 3 to 6 spiral riblets or threads; numerous crowded, irregular, transverse riblets and growth lines roughen the shell and give to the spiral ridges and riblets a knobbed appearance under a lens; color pinkish-white to white, first 2 or 3 whorls dark horn-color; altitude of type in Univ. Colo. Museum, 14 mm.; greater diameter, 18 mm.; lesser diameter 15.7 mm.; cotype in collection of L. E. Daniels 13 mm.; greater diameter, 18.5 mm.; lesser diameter, 16 mm.; cotype in Mus. Acad. Nat. Sci. Phila., alt. 14, diam. 19.7 mm.; umbilicus deep and very narrow, almost cylindrical, exhibiting whorls to the apex. The shell is more globose, the whorls of greater caliber and the umbilicus much narrower than in typical *haydeni*, and typical *betheli* is even more depressed and widely umbilicated. For purposes of comparison we republish Gabb's figure of *haydeni* (Pl. XVIII, fig. 3), and original figures of *betheli* (Pl. XVIII, fig. 1) and its variety *alta* (Pl. XVIII, fig. 2), neither of which have been hitherto figured. Binney's figures of *haydeni* do not appear to be typical. Type locality, Sta. 40, a small mountain of Paleozoic limestone nearly isolated from the main chain, south of west from Sta. 39, and southeast of Webster, Utah, under the shrub *Kunzia tridentata* and coarse-leaved herbaceous plants, and in one place in a small rock slide. Abundant. This subspecies forms another exception to Hemphill's observation concerning the geographic dividing line between the transversely-ribbed and longitudinally-ribbed forms (Binney's 2nd Suppl. Terr. Moll., p. 31, 1886).

Hemphill recorded *haydeni* from the Oquirrh Mountains and also from near Ogden, but a large series in Clapp's Hemphill collection labelled partly *oquirrhensis*, partly *haydeni* and partly *hemphilli*, all from "near Salt Lake," does not disclose any difference between them, and should probably all be called *oquirrhensis*, except perhaps two much more elevated examples which may be from a different locality.



## THE McCAMMON DISTRICT.

McCammon, Idaho, is about fifty miles northwest of Franklin.

*Oreohelix cooperi* (W. G. B.).

Sta. 1, one mile north of McCammon, Idaho, on the north side of the railroad. Several additional faint, narrow color bands below periphery.

*Oreohelix strigosa depressa* (Ckl.).

Sta. 2, about six miles up Harkness Canyon, directly east of McCammon, below the first limestone ledge, under leaves and small stones. This form is allied to *depressa* by its anatomy, but is on the average much less depressed, the whorls more convex, and few are strongly banded, though most of them show some traces of color bands, and a number exhibit several faint, narrow bands below, such as are so common in *O. cooperi*, but not so usual in *depressa*.

*Oreohelix tenuistriata* new species. Pl. XV, figs. 5, 6.

Shell small, rather depressed; whorls about  $4\frac{1}{2}$ , convex, carinated; transverse sculpture consists of numerous, crowded, sharp, wavy lines, presenting a beautiful appearance under a lens, crossed by a number of indistinct, raised, spiral lines; umbilicus open, exhibiting all of the whorls; color of live shell unknown, but probably a dirty white; exact measurements of adult unknown, but diameter about 9 mm., altitude about 5 or 5.5 mm. The paratype in Coll. Acad. Nat. Sci. Phila. measures, alt. 5.1, diam. 8.5 mm. In general appearance and sculpture it closely resembles *O. carinifera* Pils., but the transverse sculpture is sharper than in the two specimens of that species we have been able to examine. Also the second embryonic whorl is sharply striate and convex, while in *carinifera* and *hemphilli* it is smooth and convex and in *yavapai* it is smooth and flatter.

Type locality, Sta.  $1\frac{1}{2}$ , a canyon between McCammon and Hot Lava Springs, Idaho, about two miles southwest of the latter place. Only three examples were found, all more or less broken. One is in The Academy of Natural Sciences of Philadelphia, one in the University of Colorado, and the type in the collection of Mr. Daniels. These specimens were all submitted to Dr. Pilsbry, who says they represent an undescribed species and belong to the *hemphilli* and *carinifera* group. With more and better material this may prove to be a subspecies of one or the other, but it does not at present seem probable. With it were found, sparingly, *Vallonia gracilicosta* Reinh., *Euconulus fulvus* Müll. and *Vitrina alaskana* Dall.

**Pisidium huachucae** Pils. and Ferr.

In a spring near Port Neuf River, north of McCammon, Idaho.  
Identified by Dr. Sterki.

#### EXPLANATION OF PLATES XV, XVI, XVII, XVIII.

PLATE XV.—Fig. 1.—*Oreohelix peripherica*, six examples from Sta. 26, North Ogden Canyon, Utah.

Fig. 2.—*Oreohelix peripherica*, six examples from Sta. 30, near Cache Junction, Utah.

Fig. 3.—*Oreohelix peripherica*, nine examples from Sta. 31, near Cache Junction, Utah.

Fig. 4.—*Oreohelix peripherica*, two abnormal specimens from Sta. 4, near Trenton, Utah.

Fig. 5.—*Oreohelix tenuistriata* n. sp., 3 views of type specimen from near Hot Lava Springs, Idaho. In collection of L. E. Daniels.

Fig. 6.—*Oreohelix tenuistriata* n. sp., 3 views of cotype from near Hot Lava Springs, Idaho. In Univ. Colo. Museum.

Fig. 7.—*Oreohelix hemphilli eurekensis* n. subsp., 3 views of type specimen from Eureka, Utah, in Univ. Colo. Museum.

Fig. 8.—*Oreohelix hemphilli eurekensis* n. subsp., 3 views of co-type from Eureka, Utah. In Acad. Nat. Sci. Phila.

PLATE XVI.—Fig. 1.—*Oreohelix strigosa fragilis*, six examples from Sta. 39, east of Webster, Utah.

Fig. 2.—*Oreohelix strigosa buttoni*, four examples from Sta. 16, Taylor Canyon, near Ogden, Utah.

Fig. 3.—*Oreohelix haydeni gabbiana*, five examples from Sta. 15, Oquirrh Mts., Utah.

Fig. 4.—*Oreohelix haydeni hybrida*, five examples from Sta. 42, near Logan, Utah.

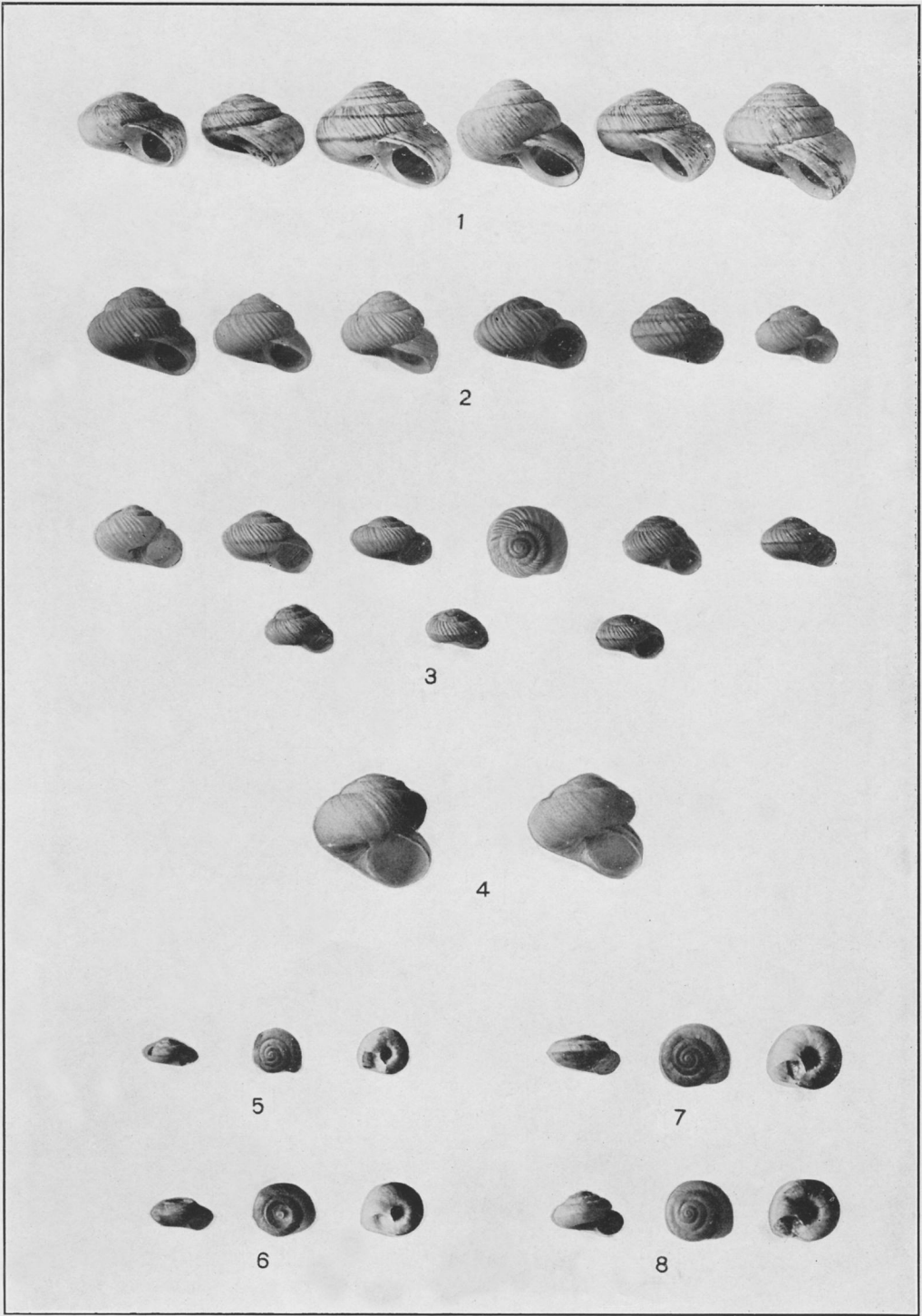
PLATE XVII.—Fig. 1.—*Oreohelix haydeni corrugata* n. subsp. Three views of four specimens from type lot, Sta. 40, southeast of Webster, Utah.

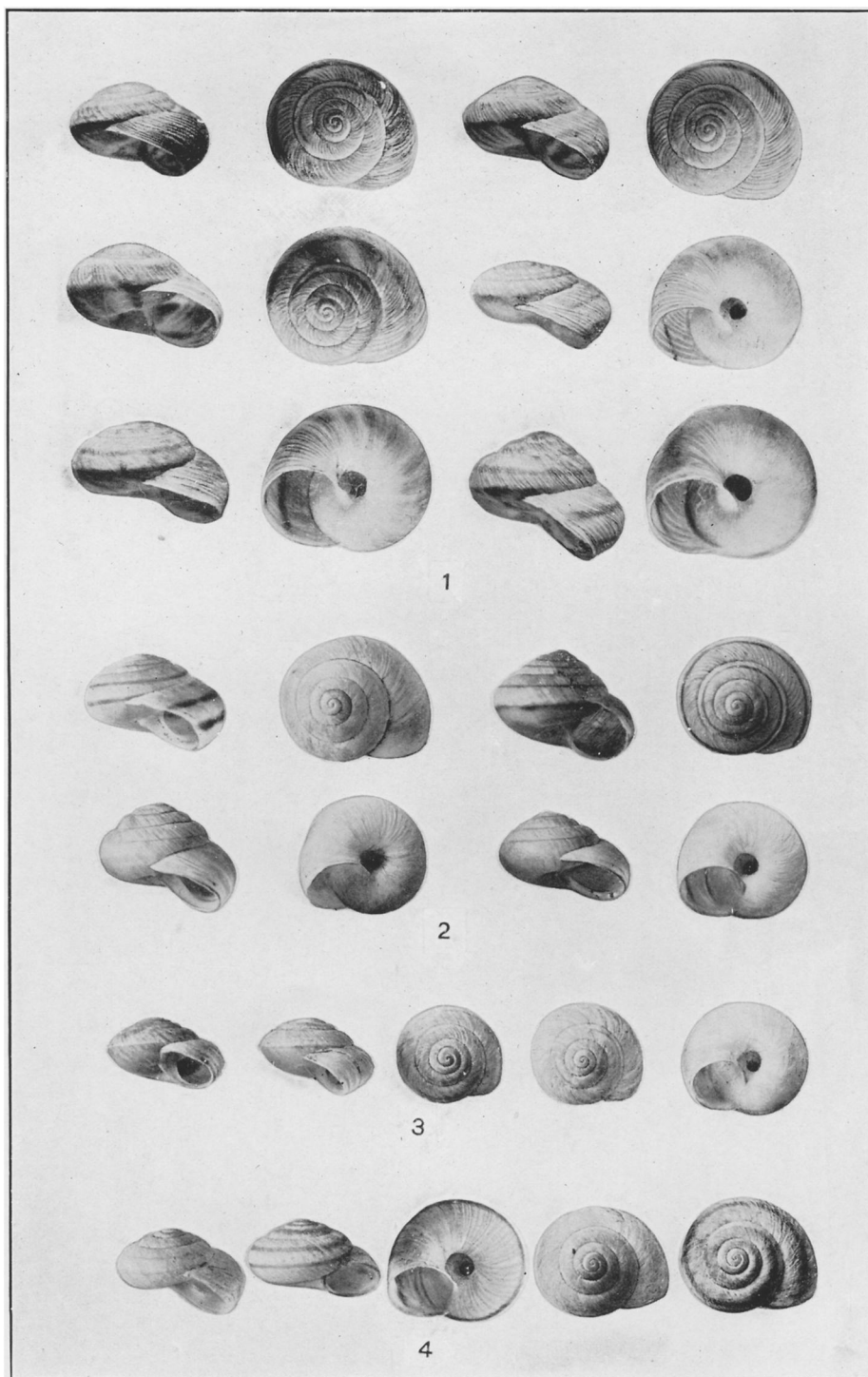
Fig. 2.—*Oreohelix peripherica* Ancey. Three views of four specimens from Sta. 29, near Cache Junc., Utah.

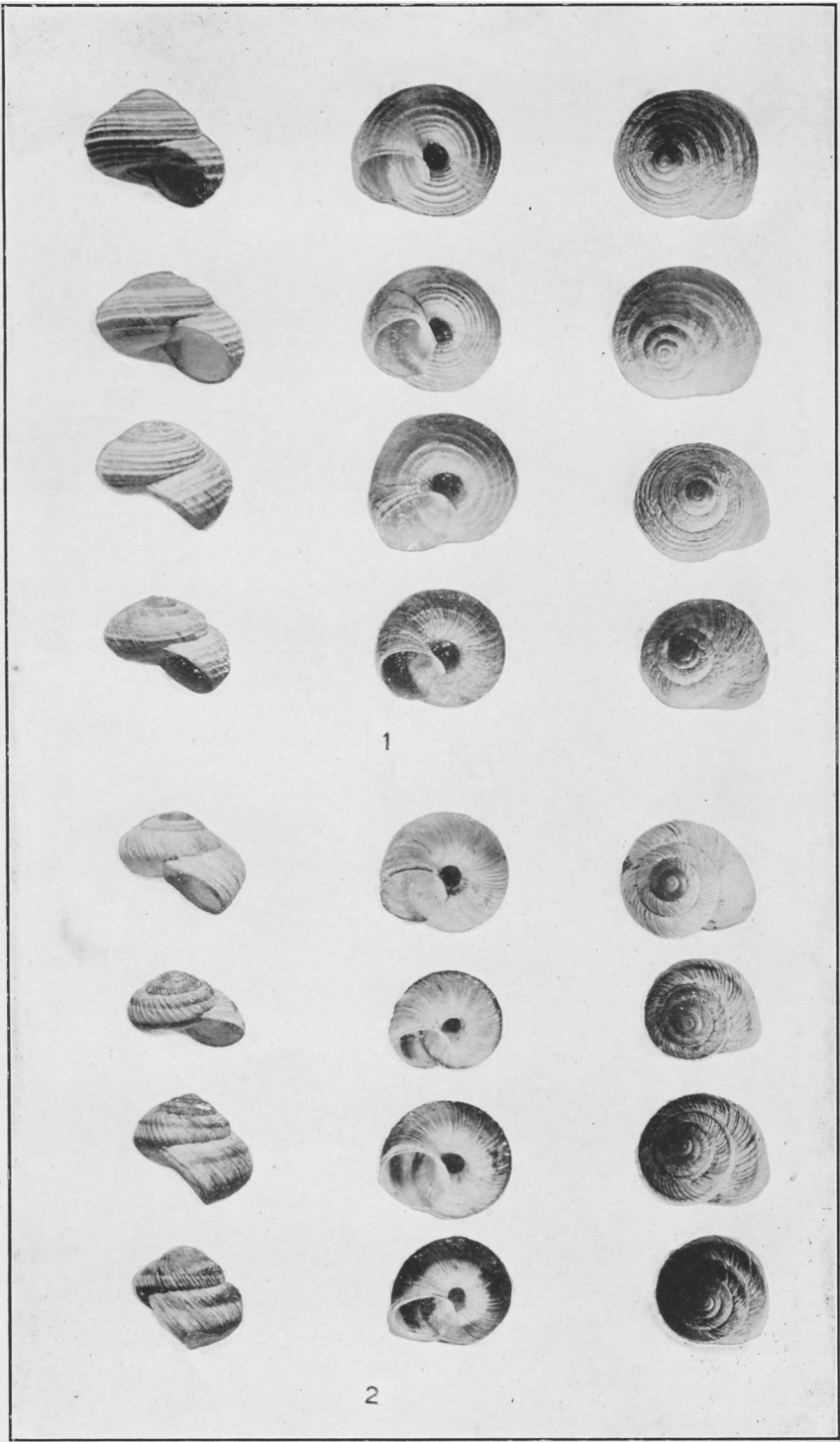
PLATE XVIII.—Fig. 1.—*Oreohelix haydeni betheli*, six examples from type locality, north of river, Glenwood Springs, Colo.

Fig. 2.—*Oreohelix haydeni betheli* var. *alta*, eight examples from type locality, south of river, Glenwood Springs, Colo.

Fig. 3.—*Oreohelix haydeni*, Gabb's original figure from Amer. Journ. Conch.







HENDERSON AND DANIELS: MOLLUSCA OF UTAH AND IDAHO.

